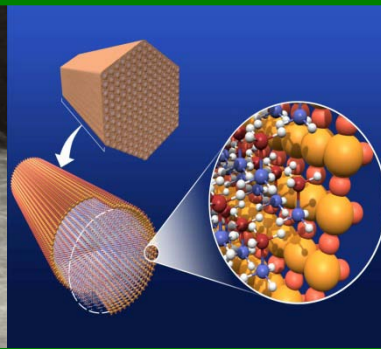




U.S. DEPARTMENT OF  
**ENERGY**



# Fuel Cell Technologies ARRA Projects - Session Introduction -

*Sara Dillich*

*2011 Annual Merit Review and Peer Evaluation Meeting  
May 12, 2011*

## *American Recovery & Reinvestment Act (ARRA) of 2009*

### **ARRA Goals:**

- **Create new jobs as well as save existing ones**
- **Spur economic activity**
- **Invest in long-term economic growth**

### **EERE Fuel Cell ARRA Project Goal:**

- **Accelerate the commercialization and deployment of fuel cells and fuel cell manufacturing, installation, maintenance, and support services**

### **Objective:**

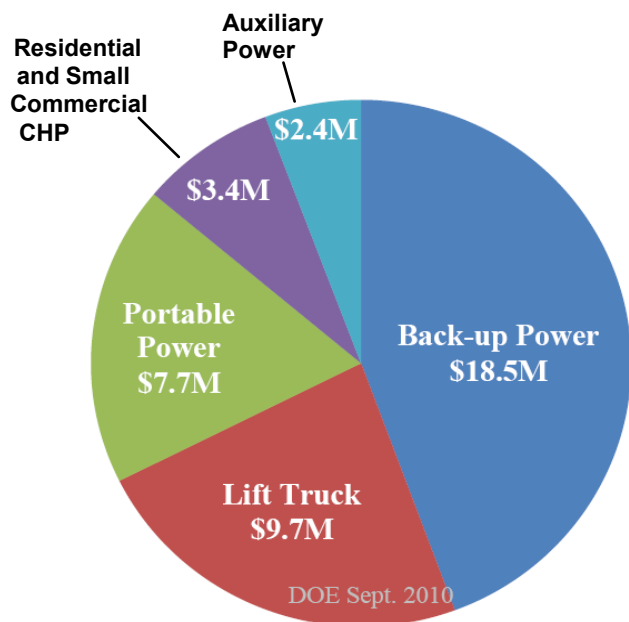
- **Deploy up to 1,000 fuel cells for early market applications**

# ARRA Fuel Cell Funding & Budget

*More than \$41 million from the 2009 American Recovery and Reinvestment Act to fund 12 projects to deploy up to 1,000 fuel cells*

## FROM the LABORATORY to DEPLOYMENT:

*DOE funding has supported R&D by all of the fuel cell suppliers involved in these projects.*



Approximately **\$54 million** in cost-share funding from industry participants—for a total of about \$96 million.

COMPANY	AWARD	APPLICATION
Delphi Automotive	\$2.4 M	Auxiliary Power
FedEx Freight East	\$1.3 M	Specialty Vehicle
GENCO	\$6.1 M	Specialty Vehicle
Jadoo Power	\$2.2 M	Backup Power
MTI MicroFuel Cells	\$3.0 M	Portable
Nuvera Fuel Cells	\$1.1 M	Specialty Vehicle
Plug Power, Inc.	\$3.4 M	CHP
Plug Power, Inc.	\$2.7 M	Backup Power
Univ. of N. Florida	\$2.5 M	Portable
ReliOn, Inc.	\$8.5 M	Backup Power
Sprint - Nextel	\$7.3 M	Backup Power
Sysco Houston	\$1.2 M	Specialty Vehicle

\* Orange = fully deployed; Yellow = project completed

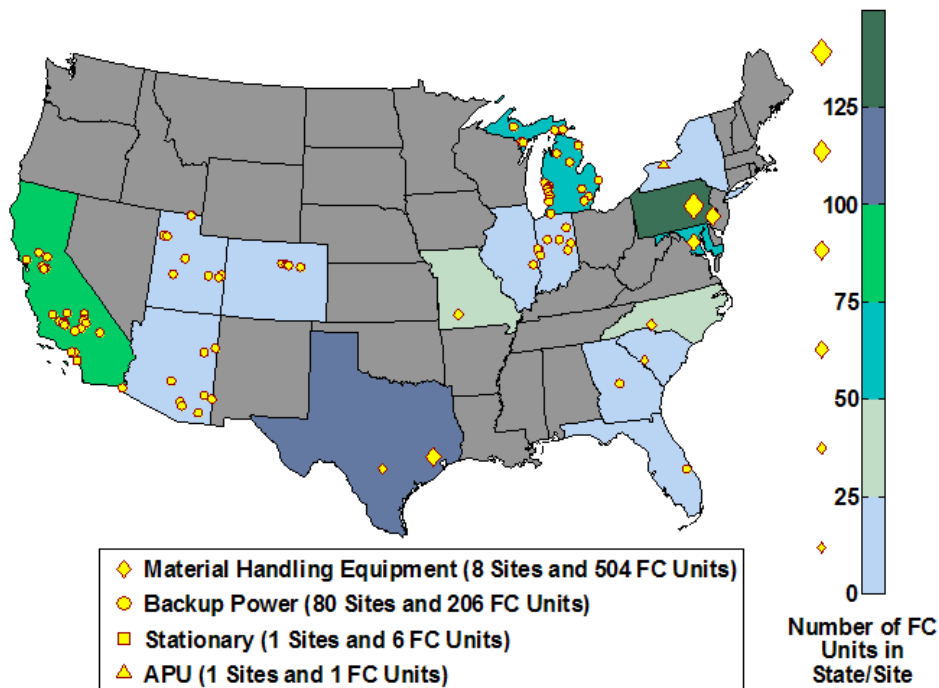
# ARRA Fuel Cell Units in Operation

## Deployment Status – April 2011

Fuel Cell Application	Operational Fuel Cells	Total Fuel Cells Planned
APU	0	3
Backup Power	267	539
Material Handling	369	504
Stationary	0	6
<b>Total</b>	<b>636</b>	<b>&gt; 1,000</b>

## NREL ARRA Data Collection Snapshot

ARRA Material Handling Equipment Data	As of 12/31/2010
Hydrogen Dispensed	> 18,500 kg
Hydrogen Fills	> 38,800
Hours Accumulated	> 307,400 hrs



*Over 400 fuel cell powered lift trucks fully deployed as of end of CY2011*

## **CURRENT STATUS**

- **12 project grants still active**
- **Over 360 fuel cell lift trucks deployed**
- **More than 260 fuel cell backup systems operational**
- **48 jobs created or retained**
- **Over 69% of funds have been spent**
- **Siting and permitting activities are continuing**
- **Safety Plans developed for all projects**
- **Site visits by Hydrogen Safety Panel have been completed, with more planned in 2011**

Status as of April, 2011



## *Completed multiple outreach and media events*

### ■ Media Events

- Sysco Houston (TX)
  - 98 lift trucks operational
- FedEx Freight East (MO)
  - 35 lift trucks operational
- GENCO
  - Kimberly Clark site (SC)
  - 25 lift trucks operational

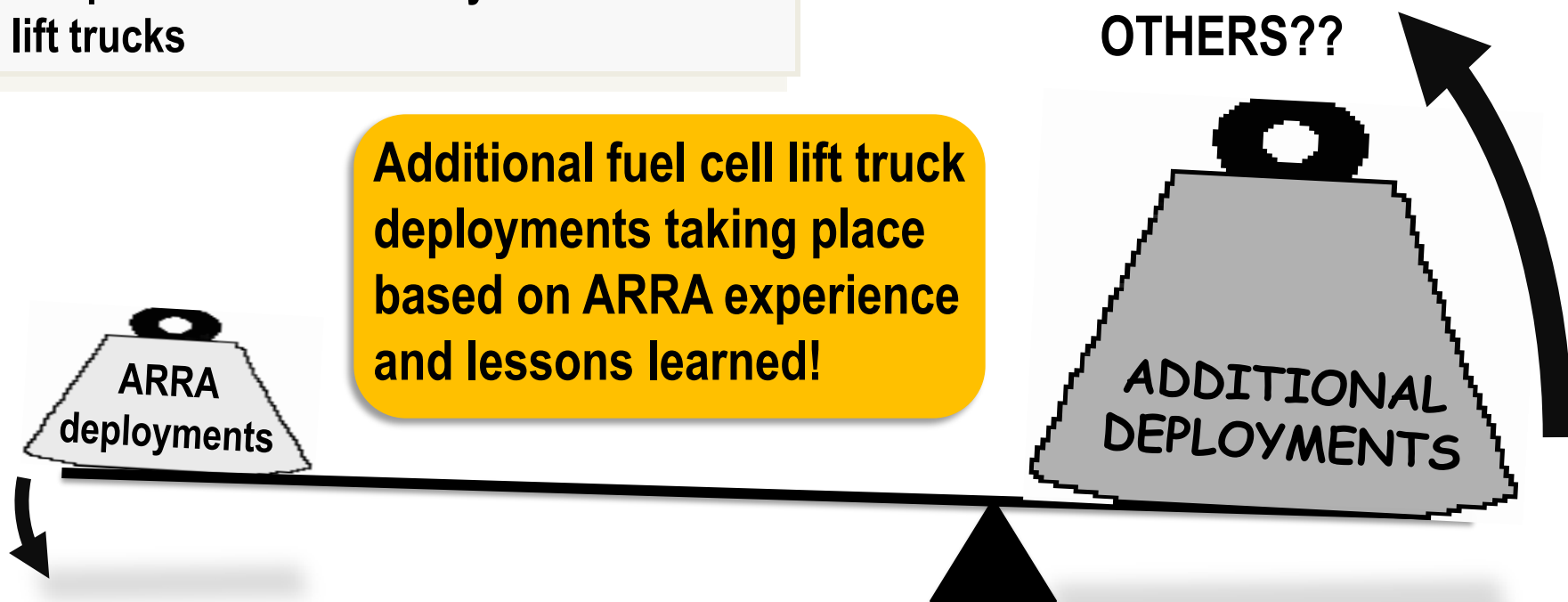
### ■ Major Presentations

- Fuel Cell Seminar & Exposition
  - October, 2010



## LEVERAGING ADDITIONAL FUEL CELL DEPLOYMENTS

- Sysco (Corporation) plans to convert an additional 500+ battery powered lift trucks to fuel cell power
- H-E-B Grocery, with Nuvera Fuel Cells, plans to expand their current fleet of fuel cell powered lift trucks by 28 additional lift trucks



*Risk management strategies are in place*

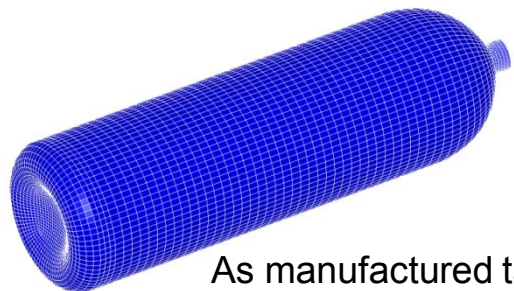
## Risk Mitigation Strategies

- NEPA reviews completed for 10 projects, 2 in progress
- Routine safety plans and reviews completed for all projects. Site visits:
  - Sysco Houston – Houston, TX
  - H-E-B – San Antonio, TX
  - Coca Cola – Charlotte, NC (planned)
  - Warner Robins AFB, GA (planned)
- Tracking metrics identified to evaluate the performance of projects (NREL)
- Costing schedule updated to account for delays (siting & permitting, NEPA)

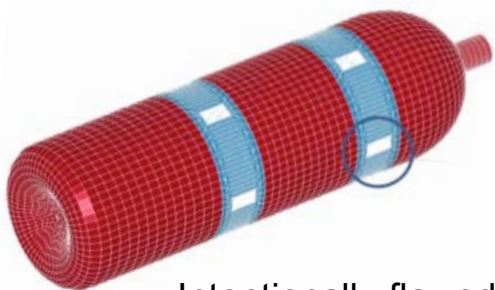




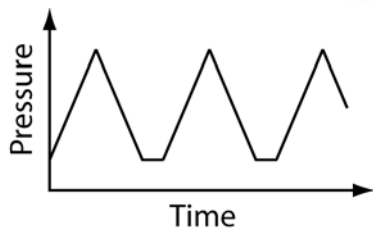
## *Safety, Codes & Standards subprogram: funding SNL lifecycle analysis of high-cycle tanks for MHE*



As manufactured tank



Intentionally flawed tank



Cyclic H<sub>2</sub> Pressure Loading

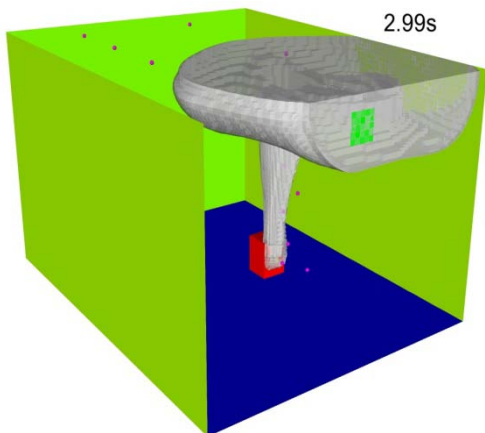
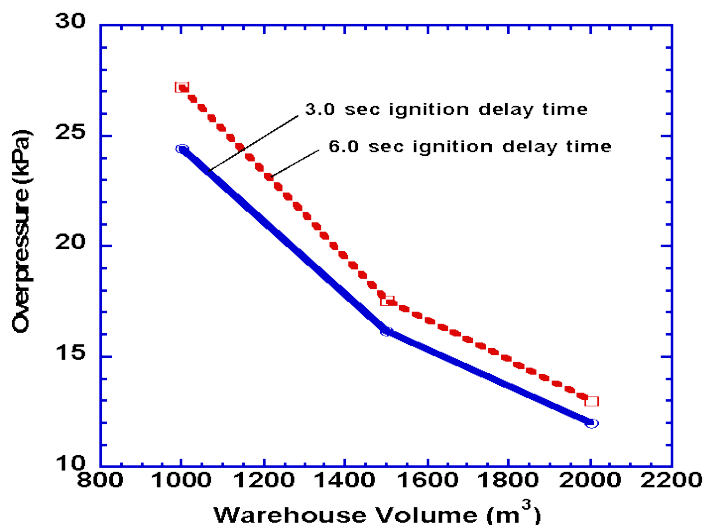
**Addressing cyclic fatigue of steel tanks to provide technical basis for code language for tanks (CSA HPIT1, SAE J2579)**

- **Quantifiable data for crack initiation, crack growth, leak before-burst**
- **Developing unified design methodologies for high cycle-life tanks**

### **FY10 Results:**

- **“As manufactured” tanks subjected to >34,000 cycles**
- **Intentionally flawed tank cycle-life exceeds predictions for crack growth**
- **New appendix proposed for SAE J2579**

## *SNL developing technical basis for refueling requirements*



### Developing the science-basis for indoor refueling requirements in NFPA 55/2

- Unintended release model development
- Experimental validation
- Participation in requirements development

### FY10 Results:

- Dispersion and over-pressure model validated with 1/2.8 scale experiments
- Data obtained for realistic leak scenarios (input from tank testing)
- NFPA 2 Task Group formed to establish indoor refueling requirements

# **HSDC**

NREL's Hydrogen Secure Data Center



- NREL Data Collection: Operation & maintenance data now available for MHE
- Fuel Cell & Infrastructure Data to NREL's Hydrogen Secure Data Center
- Data includes operation, maintenance, safety, and hydrogen production

**See talk by Jen Kurtz (NREL) in track F – Today, May 12<sup>th</sup> at 5:15 pm**  
***Analysis Support for ARRA Projects:***  
***Enabling Fuel Cell Market Transformation***

## DOE-EERE

- “Status and Outlook for the U.S. Non-Automotive Fuel Cell Industry: Impacts of Government Policies and Assessment of Future Opportunities” David Greene, ORNL, 2011

**AMR presentation – Track II: May 10<sup>th</sup> at 8:30 AM at Crystal City Marriott Hotel**

- **Fuel Cells Market Effects Evaluation**

**Study of initial impacts of ARRA fuel cell projects, initiated FY2011 by EERE Office of Planning, Budget & Analysis**



## **Siting and Permitting**

- **Tackle NEPA requirements first**
- **Facilitate national guidelines for siting and permitting**

## **Codes and Standards**

- **Identify and address concerns that may impact commercial acceptance of fuel cell systems**
- **Provide technical basis for codes and standards**

## **Unanticipated Events**

- **Have back-up strategies in place**
  - **Project terminations**
  - **Partner changes**
  - **Business and financial uncertainties**



## *Over halfway to ARRA goal!*

- **Over 307,400 hours have been accumulated on ARRA funded fuel cell lift trucks as of Dec 2010**
- **Over 260 fuel cells for backup power in communication towers have been deployed, with a total of 500 or more planned**
- **Over 360 fuel cell lift trucks are operational, with a total of 500 planned**
- **75 portable fuel cells for recharging consumer electronics have been field tested by end-users**
- **16 states have operational fuel cells funded through ARRA (up to 21 states will have fuel cells)**

**Plan to exceed goal of 1,000 fuel cells deployed in commercial scale applications due to ARRA funds – trumping DOE funded deployments at scale in the last 10 years!**



- This is a review, not a conference.
- Presentations will begin precisely at the scheduled times.
- Talks will be 20 minutes and Q&A 10 minutes.
- Reviewers have priority for questions over the general audience.
- Reviewers should be seated in front of the room for convenient access by the microphone attendants during the Q&A.
- Please mute all cell phones, BlackBerries, etc.
- Photography and audio and video recording are not permitted.

- Deadline for final review form submittal is May 20<sup>th</sup> at 5:00 PM EDT.
- ORISE personnel are available on-site for assistance. A reviewer-ready room is set up in *The Boardroom* (next to Salon A) and will be open Tuesday –Thursday from 7:30 AM to 6:00 PM and Friday 7:30 AM to 2:00 PM.
- Reviewers are invited to a brief feedback session – at 12:00 Noon on Friday, in this room.

## **ARRA Contacts**

### **DOE Headquarters:**

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*Donna Lee Ho*

*Jason Marcinkoski*

*Dimitrios Papageorgopoulos*

*Ned Stetson*

### **Technical Support:**

*Matthew Simon (Energetics Inc.)*

### **Golden Field Office:**

*James Alkire*

*Gregory Kleen*

*David Peterson*

*Katie Randolph*

*Reginald Tyler*

### **Technical Support:**

*Shaun Onorato (Cas-Navarro Joint  
Venture LLC)*

### **NREL Data Collection and Analysis:**

*Jennifer Kurtz*

- Fuel Cell Technologies Program Opportunities Available
    - Conduct applied research at universities, national laboratories, and other research facilities
    - Up to five positions are available in the areas of hydrogen production, hydrogen delivery, hydrogen storage, and fuel cells
- ☐ Applications are due June 30, 2011
  - ☐ Winners will be announced mid-August
  - ☐ Fellows will begin in mid-November 2011

[eere.energy.gov/education/postdoctoral\\_fellowships/](http://eere.energy.gov/education/postdoctoral_fellowships/)



**Postdoctoral fellowships in  
hydrogen and fuel cell research ►**



- **Data Collection & Analysis**

- NREL

- **Fuel Cell Developers**

- Alteryg
- Delphi
- Jadoo Power
- MTI MicroFuel Cells
- Nuvera Fuel Cells
- Plug Power, Inc.
- ReliOn, Inc.
- University of North Florida

- **Fuel Cell End Users**

- AT&T
- City of Folsom, CA
- Coca Cola
- Fort Irwin
- GENCO
- H-E-B
- Kimberly Clark
- NASCAR
- PG&E
- Sempra Energy customers
- Sprint Nextel
- Sysco Houston
- Sysco Philadelphia
- University of California - Irvine
- Warner Robins Air Force Base
- Wegmans
- Whole Foods Market

- **Hydrogen Providers**

- Air Products & Chemicals, Inc.
- Linde
- Nuvera Fuel Cells  
(via on-site NG reformer)